

AD 640 101



Technical Report

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MECHANIZATION STUDY
OF THE U. S. ARMY
HARRY DIAMOND LABORATORIES
TECHNICAL INFORMATION OFFICE,
WASHINGTON, D. C.

BOOZ • ALLEN APPLIED RESEARCH INC

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WASHINGTON, D. C.

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ABSTRACT

Mechanized library functions are performed on the IBM 7094 and 1410 computers using the Approach-By-Concept (ABC) storage and retrieval system. At present, mechanization is applied only to technical reports. The four outputs are accessions lists with supplementary KWIC Index, catalog cards, the ABC Dictionary, and current-awareness notifications. These notifications are provided as a result of the Martin Company contract for analyses of current open-source publications in selected subject areas. Because of file organization problems encountered in the first-generation model of the ABC system, a second-generation model was developed which will become operational in the near future. Periodicals are presently controlled with the aid of EAM techniques with a view to computerization in the near future. The Library staff states that the program has developed smoothly, with problem areas being worked out before they become serious.

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II.

III.

IV.

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I. SUMMARY

Mechanized library functions at the Harry Diamond Laboratories (HDL) use the Approach-By Concept (ABC) system. ABC is a computer-oriented storage and retrieval system designed to facilitate the organization of very specific and complex information for efficient and economical retrieval. At present, mechanization is applied only to technical reports. The four outputs are the accessions lists with supplementary KWIC Index, catalog cards, the ABC Dictionary, and current-awareness notifications. These notifications are provided as a result of the Martin Company contract for analyses of current open-source publications in selected subject areas.

Organization of HDL's Technical Information Office is illustrated in Appendix A. The Library subscribes to 700 periodicals. It has a collection of 18,655 books and 340,000 classified and unclassified reports with an annual increase of 2,400 and 14,200 respectively. Service is provided to the Laboratories' scientists, engineers and technicians, in person and by telephone or written request. The user relates directly to the ABC Dictionary for manual searching for desired items.

Ordinary library activities are aided by the use of EAM punched cards for the handling of periodical subscription lists and renewals,

check-in and circulation, with plans developed for addition of these procedures to the computer. These cards are used by the Library staff to simplify the subscription renewal and selective listing procedures.

II. MECHANIZATION

1. CHRONOLOGY

In late 1960, idea for the ABC system was conceived in HDL's Technical Information Office when EAM equipment became available and computer installation was planned. This office also developed and tested the system.

In December 1962, the IBM 1410 was installed. Report acquisition, cataloging, storage, preparation and production of library catalog cards, accessions bulletins, and bibliographies were incorporated into the system. Preevaluation and processing of reports were performed by contractor analysts, and batches of 200 to 250 worksheets were sent to the machine room for keypunching.

In March 1963, conversion of punched cards to computer tape was completed for more than 6,000 titles. As of December 30, 1963, the ABC system was still being developed and tested. At least 10 programs remained to be written and tested.

In early 1965, an evaluation of the system was conducted for DoD, Research and Engineering. As a part of this evaluation, the second-generation ABC system was developed. Later in the year, a test on the retrieval program was initiated. Professors from

George Washington University are conducting this analysis.

2. TECHNICAL REPORT PROCESSES

Preparation of the accessions lists, document catalog cards, ABC Dictionary, and current awareness listings on the computer involve both the Library staff and the Research Operations Branch for input to the system.

(1) Input Procedures

1. Each document received on distribution is reviewed by the Research Operations Branch for its permanent value to HDL. They are grouped into three categories: category 1-- of permanent value to HDL, category 2-- hold for a specific number of years, category 3-- not of value. Documents received as the result of a request are automatically cataloged.
2. Documents being retained in categories 1 and 2 are forwarded to the Library Cataloging Section.
3. Documents in category 3, not being retained as a part of the Library collection, are routed to individuals with possible interest in the report.

4. Cataloging Section of the Library prepares worksheets (see Appendix B-1) indicating bibliographic data or descriptive cataloging information for reports in categories 1 and 2. This includes the shelf (accession) number, report numbers, agency or source, contract number, title and volume, personal authors, date, pages, copy numbers, classification, codes, and group sequence number. Subjects and tracings are added to reports of permanent value.

5. Documents in category 1 are returned to the Research Operations Branch for addition of the concept analysis statements. A KWIC title is used for category 2 documents.

6. Worksheets are forwarded to the computer section for preparation of the catalog cards and accessions listings.

7. Concept statements are forwarded to the computer section for updating of the ABC Dictionary tape.

8. Abstract cards received from the Martin Company contract, previously cataloged and processed, are filed pending requests from users.

9. Computer tape received as a part of the Martin Company contract is forwarded to the computer section for matching against the user profile tape.

(2) Outputs

1. Accessions Lists

The computer prepares two lists; one list contains the HDL reports and the other covers all other classified and unclassified reports. Samples of these outputs are not shown because of their classification. The HDL listing is by title, referring to document report number. The other listing is arranged by the broad subject areas assigned by the Cataloging Section, then by title referring to the accession number. Following the breakdown by subject area in category 1 and 2 reports, each confidential listing has a KWIC title index.

2. Catalog Cards

Three-by-five catalog cards (see Appendix B-2) are prepared by the computer; one each for the shelf list, source, report number, individual author (HDL only), AD and other report numbers, contract number,

and, for category 1 reports, asterisk term and code (i. e., subject). These are filed in the regular card catalog for manual use by staff and users.

3. ABC Dictionary

The Dictionary (Appendix B-3) is printed from the updated master tape in a permuted concept arrangement. Copies of the Dictionary are maintained in the Library for manual reference by Library staff and users. This provides the searching tool and eliminates the necessity of a subject search on the computer. The user scans the Dictionary for the desired term or terms and proceeds to the asterisk term and code card file for specific documents. Under the second-generation system the Dictionary will include superimposed classification on the alphabetical arrangement of the ABC concepts.

4. Current Awareness Listings

This program is partially operated by a contractor. The contractor furnishes 3x5 abstract cards containing titles of periodical articles and report abstracts selected from abstracting literature and furnished on the basis of

subject categories (about 120) pertinent to the work of HDL. The 3x5 cards were introduced in the summer of 1965. Before then, aperture cards with abstracts on microfilm were provided. A computer tape was provided with the aperture cards and is also furnished with the 3x5 cards. Individual users have indicated their interest in broad subject categories. When a new input tape is run, all entries in each category in which a given user is interested are printed. This printout consists of selected listings of current references that are circulated once a month (see Appendix B-4 for sample of list) to participants in the program. Some 500 different lists go out each month.

The user selects references he thinks might be of interest and reviews the abstract in the Library. If the abstract is pertinent, the document is then withdrawn for his use, or if it is not already available in the Library, it is obtained. (Users are included in this program by request.) The user may be an individual representing himself or an Intelligence and Information Officer representing a group of men.

3. PERIODICAL HANDLING PROCESSES

With a view to computerization in the near future, periodicals are presently being recorded and controlled on EAM punched cards (see Figure 1 for sample). There are three decks consisting of one card for each title. Deck one is arranged alphabetically by title and is used for the list of holdings. Deck two is arranged by expiration date and includes the full renewal record. Deck three is arranged by source record for renewal purposes. The current year's subscriptions have been entered through a contractor agent rather than direct to the source or publisher. Should this prove successful, Deck three could be eliminated.

PUB		DATE OF EXP		PRICE		TITLE																														LAB		P		ISSUE		P.O. NO.																																					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
HDL										TECHNICAL LIBRARY																														PERIODICAL RECORD																																							
NAME OF BORROWER		DATE DUE																																VOL.																																													
																																		NO.																																													
																																		COPY																																													
																																		DATE																																													
																																		FREQUENCY CODE																																													
WEEKLY		1	BI-MONTHLY		5																																																																										
BI-WEEKLY		2	QUARTERLY		6																																																																										
SEMI-MON		3	SEMI-ANN		7																																																																										
MONTHLY		4	OTHER		8																																																																										
AMXDO FORM		REV. 30 SEP. 63		408																																																																											

FIGURE 1
Punched Card Used for Handling Periodicals

As soon as a renewal or a new subscription is entered, a punched card is produced for each issue of each volume expected throughout the year. These are arranged by month, then alphabetically by title. When the issue is received, the punched card is pulled manually and inserted into a pocket in the back of the copy. This then becomes the circulation record. Any remaining cards at the end of the month are used as the basis for claiming. Seven hundred titles are received yearly; 28 weekly, 21 semimonthly, 11 biweekly, and the rest monthly.

III. PROGRAM SYSTEM DATA

The presently operating system is known as the first-generation ABC system. Appendix C discusses the development of a second-generation system and how it differs from its first-generation counterpart.

The overall planned system for Library automation is shown in Figure 2. The functions of each of the blocks of the planned system are as indicated. However, at the present time, only five of the indicated functions are operational; descriptive cataloging, subject analysis, ABC Dictionary updating, subject card catalog updating, and automatic dissemination. In more general terms, the first four functions are more conveniently grouped together as only two functions, namely, cataloging and ABC Dictionary updating. The fifth function is an unsophisticated Current Awareness program that will be developed further. The following discussion deals only with these operational portions of the ABC system.

1. DESCRIPTION OF FILES

Appendix D (Figures D-1 through D-8) illustrates the format for the files discussed below.

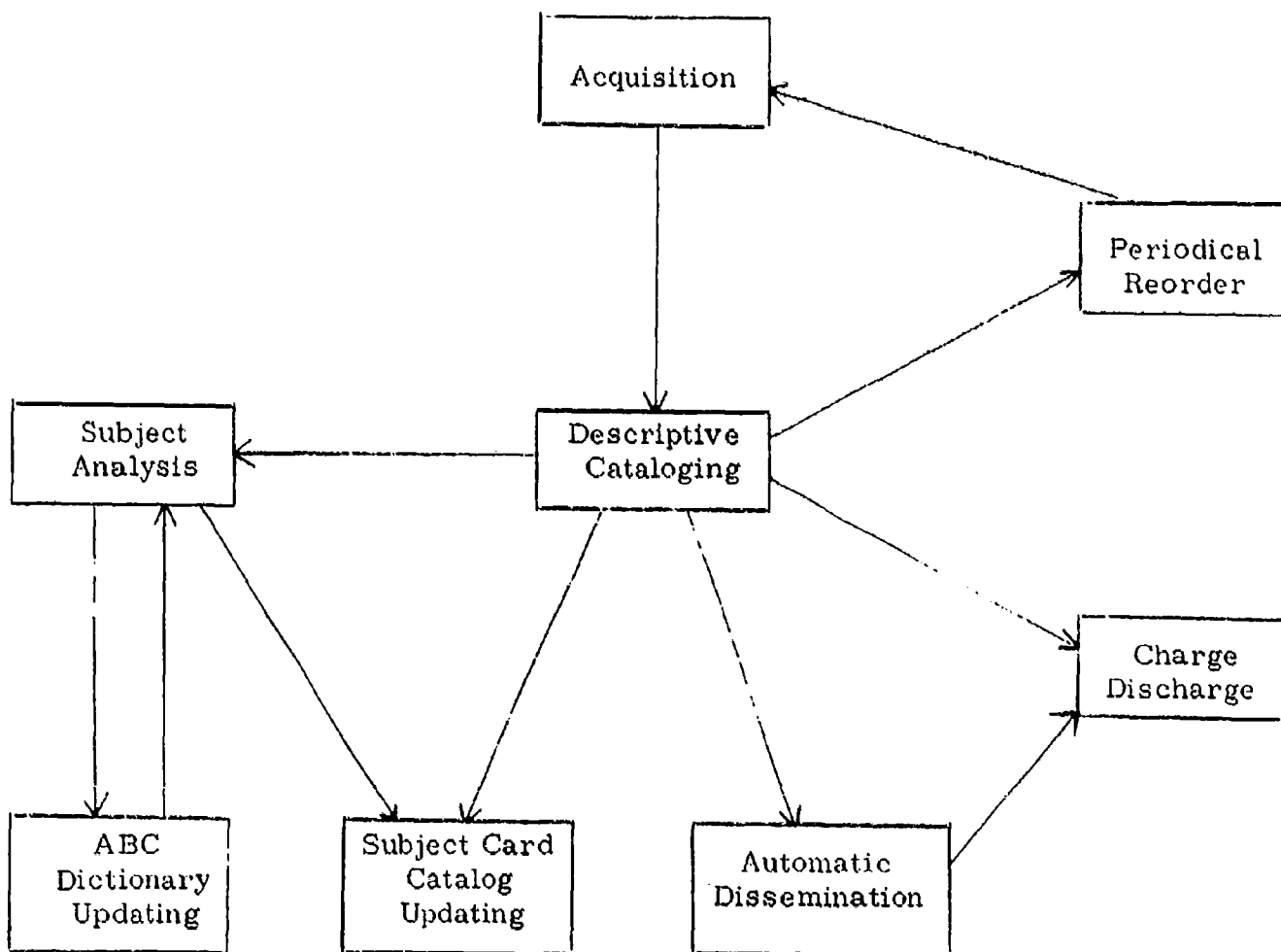


FIGURE 2
Functional Block Diagram of ABC System

(1) Cataloging System Files

Four permanent storage files and four intermediate working files form the basis of the cataloging system. The files contain the concepts that described the basic documents; they are used to produce accessions bulletins and catalog cards.

The following storage files are used:

1. Cumulative Catalog Update Card File

This is a cumulative file of 80/80 images of all cards used to update the catalog system.

2. Cumulative Catalog File

This is a variable length file of bibliographic and descriptive information. Each record is a multiple of 48 characters in length. Each group of 48 characters comprises a two-digit "card code", 45 characters of data, and one blank. The card codes and types of data are discussed in the description of the cataloging system routines. More than one record may refer to a single document. These records contain the same information, permuted so that each of the "card" types appears as the leading group of 48

characters in the record, simplifying multiple catalog card prints.

3. Partial Subject File

This is a variable length file of bibliographic and descriptive information, similar in format to the Cumulative Catalog File. In this file, however, permuted records for a single document are excluded. One record exists for each asterisk term included in the concept under which the document has been cataloged. The term and its code appear as the first 48-character group in the record. One record is included that has the shelf number first, for each category i report that has not yet been assigned an asterisk term and code (subject entry).

4. Cumulative Rotated Title File

This is a file of 132-character records containing the document title and shelf number. Each record is set up in KWIC format.

The following intermediate files are output files from the programs indicated.

1. Drive 1 from BULLETIN PRINT
 - Input to sort and print catalog cards
 - Input to file of all catalog information
2. Drive 4 from BULLETIN PRINT
 - Input to print accessions list in KWIC format
 - Input to update Cumulative Rotated Title File
3. Drive 5 from BULLETIN PRINT
 - Input to sort and update Partial Subject File
4. Drive 2 from PRINT BE-PIP
 - Used for subsequent printouts

(2) ABC Dictionary Updating System Files

Three permanent storage files and four intermediate working files are required to maintain the ABC authority. Additions, changes, and deletions are made to the Dictionary, and a listing is made for use in both indexing and searching.

The storage files are as follows:

5. ABC Dictionary File

This is a file of 84-character records containing all concepts and codes.

6. Valid Asterisk Terms File

This is a file of 80-character records; each record contains 37-character asterisk terms and 6-character codes. All valid asterisk terms from the Dictionary are included.

7. Reports Subject File

This file is similar in format and content to storage file 3, differing only in that zero cards (shelf number) are omitted.

The following intermediate files are output files from the programs indicated.

5. Drive 4 from DICTIONARY UPDATE

- Input to sort and delete and replace asterisk terms, contains all deletions and their replacements

6. Drive 2 from PRINT BE-PIP

- Used for subsequent printouts

7. Drive 3 from DELETE AND REPLACE

- Input to sort and change Reports Subject File

8. Drive 3 from COMPARE AND CHANGE

- Input to sort and change Reports Subject File

2. DESCRIPTION OF ROUTINES

It is emphasized that the presently operating versions of cataloging and ABC Dictionary updating are not the same as those planned for implementation in the future since several refinements for simpler operation as well as for more readable outputs will be incorporated into the final system.

Flow diagrams of the cataloging system and the ABC Dictionary Updating System are shown in Figures 2 and 3. It should be noted that each rectangular block in these flow diagrams indicates a separate computer program (routine). The circular symbols are tapes, with the drive numbers on which they are mounted indicated as "DR x" as appropriate.

(1) Routines for Cataloging System

As input to the cataloging system, IBM cards are punched in a format designed especially for this application. These cards are punched from a worksheet (Appendix B-1) on which each line represents a single IBM punched card. In this format, the shelf number of each item (card columns 1-8) is repeated

on each punched card, as is the group sequence number in columns 74 to 79 (broad-subject-category).^{*} Thus, the cards for a given item to be cataloged are easily sorted together on these numbers.

However, in order to (a) identify what portion of an entry is signified by a given card, and (b) properly sequence the cards within a given type of card, e. g., a title card, two additional numbers are added to each punched card. These are the card numbers contained in columns 10 and 11. The first (column 10) is a card-type code indicating the type of information in the data field as follows:

<u>Card Type</u>	<u>Data</u>
0	Shelf Number
1	Report Number
2	Corporate Author
3	Contract or Project Number
4	Title

* Only the first three positions are currently used. These represent a broad subject category, which is used at present only to organize the periodical accessions bulletins into subject categories. Thus, the primary method of sorting inputs is by this subject category, the secondary method of sorting is by the shelf number, and the tertiary method of sorting is by the two-digit card numbers (columns 10 and 11).

<u>Card Type</u>	<u>Data</u>
5	Personal Author
6	Miscellaneous (date, pages, classification, etc.)
7	Subject
8	Tracings

The second digit (column 11) merely provides for proper sequencing of cards within a similar type (column 10) entry.

The data that are subsequently used for printing are all (except for shelf number) punched in columns 12 to 62.

The present cataloging system produces two-part accessions bulletins, catalog cards, and appropriate files of information on magnetic tape (See Figure 3 for flow diagram). The two-part accessions bulletins are composed of (1) a bibliographic listing (in broad-subject-category order) which is printed by the Bulletin Print program, and (2) a KWIC rotated title list that is prepared from a tape output from the Bulletin Print program by the BE-PIP (Bell Permutation Index Program) 7090 program; the BE-PIP program was supplied by the IBM SHARE system from the original author, the Bell Laboratories.

The catalog cards are printed from a tape prepared by the

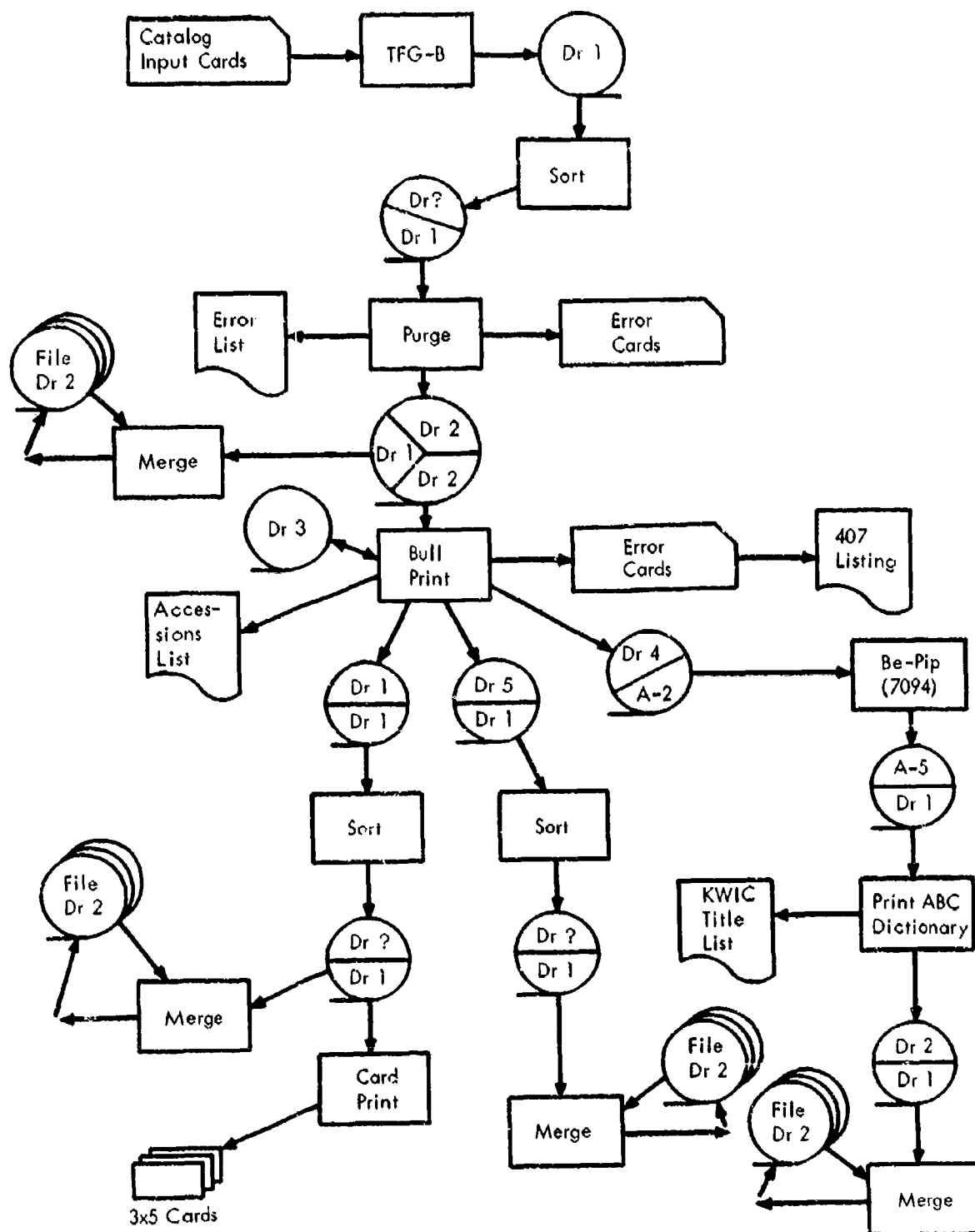


FIGURE 3
Flow Diagram of Cataloging System

Bulletin Print program only after this tape has been sorted into approximate filing order for ease in placing the cards in the catalog drawers. The tape files maintained are useful for such operations as subject card catalog updating and the possible printing of additional catalogs and lists (such as the recently provided list of corporate authors and contract and project numbers).

The following 13 routines pertain to cataloging and producing accessions bulletins.

1. TFG-B (1410)

An IBM utility routine for card-to-tape operations. In this instance, images of catalog updating cards are recorded on tape.

2. Sort (1410)

Card images are sorted into sequence by subject category number, shelf number, and card sequence number.

3. Purge (410)

Card images are scanned for detectable errors, which are punched onto cards, listed, and deleted from the tape to be corrected and reintroduced into the system in the next run.

4. Merge (1410)

All valid card images remaining are merged into the Cumulative Catalog Update Card File (storage file 1).

5. Bulletin Print (1410)

All valid card images are input to this program, which prints the bibliographic data in an accessions bulletin. Three output tapes are generated to become inputs to subsequent programs. All card images relating to a single document are assembled into a single record. Other records are created containing the same data but permuted so that each card image appears once as the first card of a record (intermediate file 1). These records are written on tape (Drive 1) to be sorted before printing catalog cards. Titles and shelf numbers are output to the tape in Drive 4 (intermediate file 2) for input

to the Bell BE-PIP program, which produces a rotated title list. The tape on Drive 5 (intermediate file 3) is used to maintain the Partial Subject File which, in turn, is used for updating the subject card catalog with the ABC Dictionary Updating System.

6. Sort (1410)

The Drive 1 output from the Bulletin Print program (intermediate file 1) is sorted by card type and by the alphanumeric information contained in the first three cards of the record.

7. Card Print (1410)

This program simply prints catalog cards in approximate filing sequence.

8. Merge (1410)

All records used for printing catalog cards are merged into a Cumulative Catalog File (storage file 2).

9. Sort (1410)

The output from BULLETIN PRINT on Drive 5 is sorted by subject code if available or by shelf number.

10. Merge (1410)

These sorted records are merged into the Partial Subject File (storage file 3) for subsequent use in updating the subject card catalog with the ABC Dictionary Updating System.

11. BE-PIP (7094, Bell)

The Drive 4 output from BULLETIN PRINT is input to this program which is unchanged as received from the IBM SHARE system. The program rotates and searches the data and produces 120-character print images in KWIC style; that is, titles appear in a sequence in which key words appear alphabetically. These print images are written as the second file of output tape on Drive A-5 (intermediate file 5). All other outputs of this program are discarded.

12. Print ABC (1410)

This program prints the second file of the tape producing the rotated title listing and writes the same information on another tape in 132-character records, as the first file.

This listing becomes the second half of the accessions bulletin.

13. Merge (1410)

The above records are merged into a Cumulative Rotated Title File (storage file 4).

(2) Routines for ABC Dictionary Updating System

The ABC Dictionary Updating System (Figure 4) provides the means for adding new terms to this open-ended Dictionary, for changing terms in the Dictionary, and for deleting terms. Since a deletion would be made only to combine several entries having similar meanings, reports cataloged under the deleted entry must be automatically recataloged to the other entry having the same meaning.

14. ABC Dictionary Update (1410)

This program accepts changes to the ABC Dictionary in the form of additions (new concepts to be added), changes to existing entries (rewording or changing asterisk terms) or deletion/replacements (deletion of a concept and replacing all references to it with references

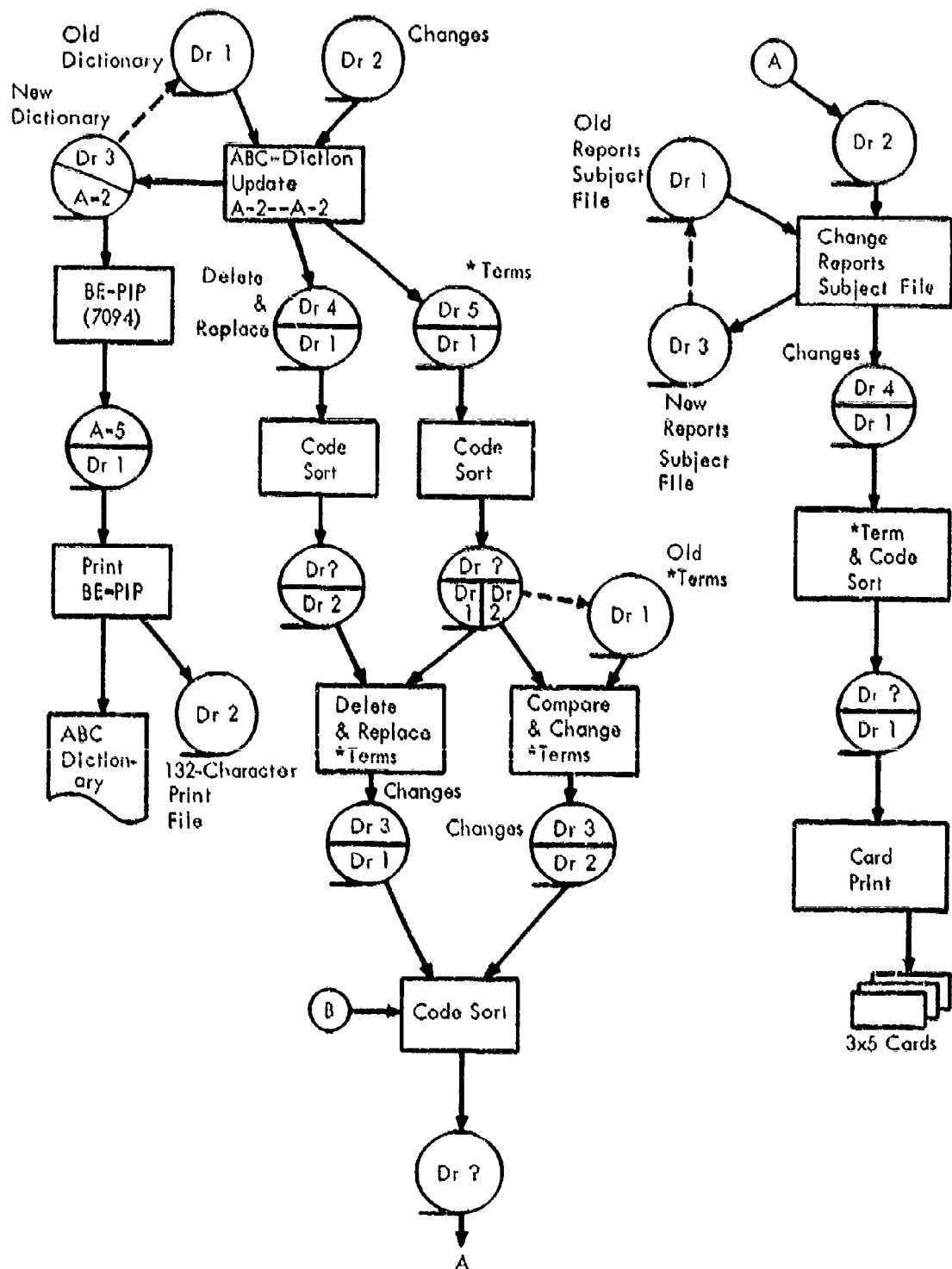


FIGURE 4
Flow Diagram of ABC Dictionary Updating System

to another concept already contained in the Dictionary). The most recent version of the Dictionary tape (storage file 5) and a tape of update card images (Cards 1 and 2) are inputs to this program. The program produces a new Dictionary with the required changes. In addition, it produces two files (intermediate file 5 and storage file 6) that are used to carry those changes into the Reports Subject File.

15. BE-PIP (7094, Bell)

This program, as described above (Program 11) produces a Rotated concept File from the new Dictionary tape.

16. Print BE-PIP (1410)

This program prints the ABC Dictionary in rotated title format, from the second file on the tape produced by Program 15. In addition, it produces a new tape from which additional copies of the Dictionary may be printed more rapidly.

17. Code Sort (1410)

The Deletions and Replacements File (intermediate file 5) is sorted by the "new" subject code.

18. Code Sort (1410)

The Valid Asterisk Term File (storage file 6) is sorted by subject code.

19. Delete and Replace Asterisk Terms (1410)

Both of the above sorted files are input to this program. For each deletion record encountered, its "new" subject code is used to search the Valid Asterisk Term File, and one record is produced on the output tape for each valid term found (intermediate file 6).

20. Compare and Change Asterisk Terms (1410)

The Valid Asterisk Term File is compared to the Valid Asterisk Term File saved from the previous updating run. Terms in the "new" file that differ from terms in the old file are written into an output file (intermediate file 7).

21. Code Sort (1410)

Changes from Program 19 and 20 are sorted together by "old" code.

22. Change Reports Subject File (1410)

Changes are now incorporated into the Subject File (storage file 7). The format of this file is identical to that of the Partial Subject File (storage file 3) except that zero cards (shelf number) are excluded. "Old" subject codes on the change tape are matched against subject codes in the Subject File. When a match is made, the "new" code and asterisk term is substituted and a "new" Subject File is produced. A file (Drive 4) is produced in the same format, but it contains only items to which changes have been made, rather than the entire Subject File. Entries on the change tape for which no reference is found in the Subject File are listed on a separate output error tape.

The Subject File produced by this program must be sorted by subject code before further use.

23. Asterisk Term and Code Sort (1410)

The output file from Program 22, containing only changed entries, is sorted by asterisk term and code.

24. Card Print (1410)

This is the same as Program 7. New catalog cards reflecting changes are printed for filing.

IV. EQUIPMENT, COSTS, AND EVALUATION

1. EQUIPMENT

<u>IBM 7094</u>	The 7094 is running two shifts, but not at full capacity.
7094	with 32K core memory
10 729	Mod IV Tapes, 5 on Channel A, 5 on Channel B; 2 on Channel A and 2 on Channel B are switchable to Channel 1 of 1410.
407	printer
711	low-speed card reader
 <u>IBM 1410</u>	 The 1410 is overloaded, primarily with various printing jobs.
1410	with 40K core memory
2 729	Mod IV tapes, 1 on Channel 1, 1 on Channel 2
1402	card reader/punch
1403	printer with 132-character positions; Channel 2

2. COSTS

The following costs are taken from the results of the performance test conducted by HDL's Technical Information Office in early 1965. These figures take into consideration the money that was spent to organize the test collection in accordance with the ABC storage and retrieval method.

All expenditures have been reduced to unit cost, i.e., cost per title, and wherever feasible, an indication of the time involved in the individual operation is given.

For the selection of the test collection
and the preparation and standardization
of the concepts for 3,650 accepted titles,
the total cost was \$10,674.60 and the
unit cost was \$2.91

For the input into the computer memory,
an average of six punched cards per
title was required. At a unit cost of
\$0.07, the cost per title was 0.42

For the printout of three different
catalog cards and one bibliographic
listing of the collection, a total
of 24 lines per title at \$1/minute
(1410) machine rental, the cost per
title was 0.11

For the KWIC title list (a nonessential
tool for the customary reference service),
about five lines were permuted at \$8/min.
by way of the 7094 computer and printed
at \$1/minute by the 1410 computer with
a per title cost of 0.06

For permuting 4,000 concepts with the 7094
computer, the total cost was \$150, and
the cost per title was 0.04

For the printing of the ABC Dictionary
with the 1410 computer, the cost of an
average of six lines per title amounted to 0.01

TOTAL \$3.55

NOTE: Additional cards create a cost increase
of up to \$0.02.

In the expenditures, only the cost of printing one Dictionary was included. Every additional accumulation requires another printing of the same title, at a title cost of \$0.01. Therefore, if the average title added to the collection will be published in a second accumulation during the first year and then be included in the yearly accumulations in its second and third year, the cost of three accumulations must be added, an increase of \$0.03 per title.

3. FACILITY'S EVALUATION OF SYSTEM

Owing to the fact that a programmer was trained and used in the Technical Information Office, many of the problems that might exist between programmers and Library staff were nonexistent.

As far as the Library staff is concerned, the program has developed smoothly, with changes being worked out before they become serious problems. Formats for input are satisfactory, and the outputs have proved very useful. The Research Operations Branch feels that the only problems that exist are concerned with the feasibility of new ideas and whether these can be incorporated into the programs.

Advantages to the system at the present time seem to be in the natural language used for analysis, organization, and retrieval and in the browsing convenience to the user.

The primary objective of a performance test conducted early in 1965, was to spot deficiencies in the existing system and to develop the second-generation ABC model. In the test, a reasonable recall potential was provided for by requiring a test collection in depth; that is, the scope of the subject area was narrowed (and therefore deepened) to solid state devices, circuits, and applications. This subject area allowed for a conventional subject card with multiple entries and abstracts, thus enabling evaluators to check on the completeness of the retrieval and to determine the recall ratio. Results of the controlled performance test of 36 freely styled questions were a relevance ratio of 88.4 ± 2.6 percent and a recall ratio of 24.7 ± 5.2 percent. The recall ratio was computed on the basis of all pertinent, relevant documents in the collection and was the proportion of the total of the +, =, and - rated items to the total of the relevant documents.

The second-generation model is characterized by descriptors of unlimited length, the introduction of facets or microschedules which produce logical organization of documents under important keywords, and a decrease in the number of verbalized concepts (or statements). Type of document, level-of-difficulty descriptions, and operating parameters of equipments (a feature of the ABC method) are transferred to card catalogs.

This second-generation system is based on experience gained in the test; on the analysis of difficulties that scientists, subject specialists, and librarians encountered as they used the first-generation system; and on a previously conceived ideal storage and retrieval system.

A retrieval test is currently being conducted at HDL. Scientists at HDL make out questions, obtain answers, and then evaluate their own results. George Washington University professors check these results. In this test, the relevance ratio is usually about 87 percent and recall ratio is 10 percent below maximum. It is expected that these percentages will deteriorate with a larger collection.

B I B L I O G R A P H Y

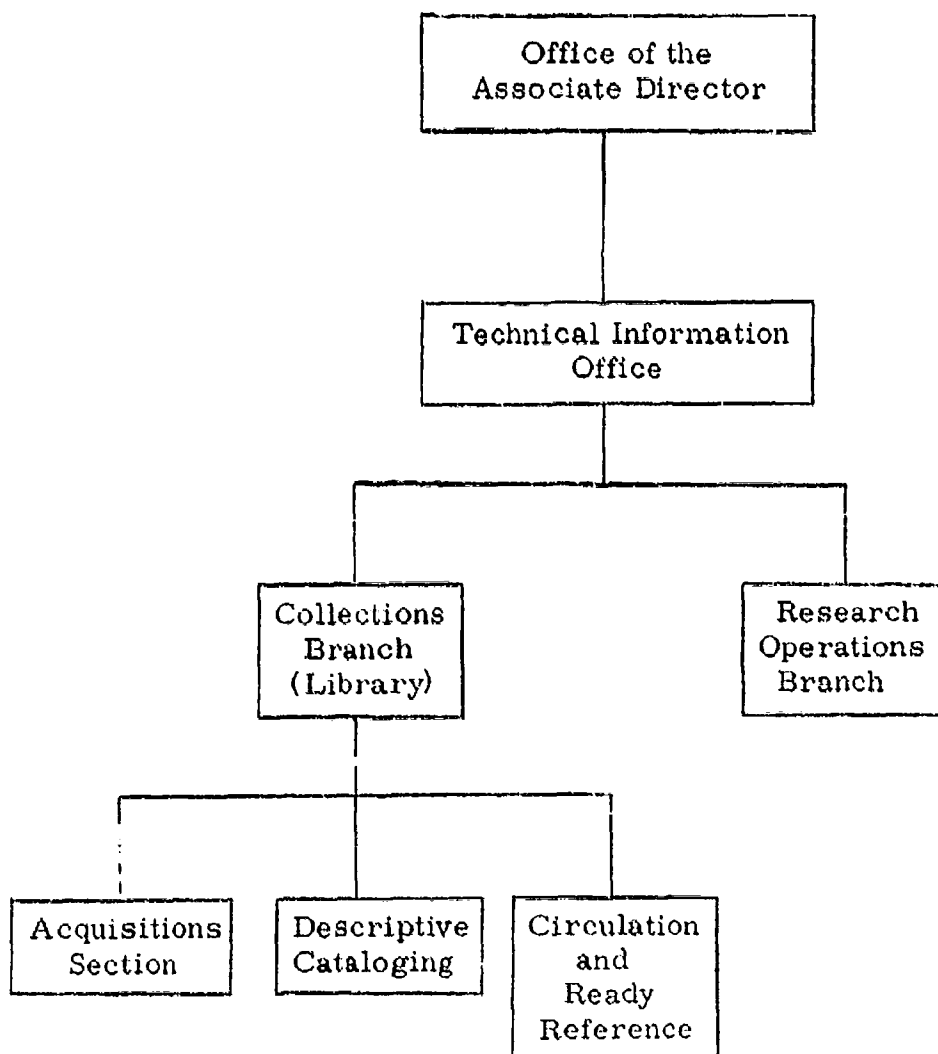
A Multiple Testing of the ABC Method and the Development of a Second Generation Model, by Berthold Altmann with a supplement of Computer Programs of the HDL Information System, by William G. Brown, an internal unnumbered publication of the Harry Diamond Laboratories.

Technical Information Office Collections and Services, 15 May 1964, Harry Diamond Laboratories.

APPENDIX A

ORGANIZATION OF TECHNICAL INFORMATION OFFICE

HARRY DIAMOND LABORATORIES
ORGANIZATION OF TECHNICAL INFORMATION OFFICE



APPENDIX B

SAMPLE OF WORKSHEET AND OUTPUTS

B-1

LIBRARY CATALOGING WORKSHEET

Shelf No. (1-8)	Card No. (10-11)	Misc. Nos (12-50)	Report Nos (32-55)	Codes (57-62)	Orig/Seq (74-79)	
Report ↓	11	Report Nos (32-55)			Report ↓	
	12					
	13					
	14					
↓	21	Agency (12-55)			↓	
	22					
	23					
	24					
↓	31	Contract/Project No. (12-55)			↓	
	32					
	33					
↓	41	Title and Volume (12-55)			↓	
	42					
	43					
	44					
↓	51	Personal Authors (12-55)			↓	
	52					
	53					
↓	61	Date (12-16)	Pages (22-25)	Copy Nos. (31-40)	Class (52-54)	↓
↓	71	Subjects (12-48)			↓	
	72					
	73					
	74					
	75					
	76					
↓	81	Tracings (12-55)			↓	
	82					
	83					
	84					
	85					
	86					

AMCDO FORM 476
(Rev) 9 July 1963

LIBRARY CATALOGING WORKSHEET

This form supersedes ORDTL 476 dated 17 Dec 1961

Figure D

APPENDIX B(2)

B-2

COMPLETE SET OF CATALOG CARDS

63-97465			
TR-7321 MICHIGAN INTENSIVE INSTITUTE FOR RESEARCH IN PHYSICS AND ELECTRONICS BZD 44-246-9A16			
COMPUTER MEMORY FOR OPTIMAL PERFORMANCE UNDER HIGH SPEED REQUIREMENTS CONDITIONS SELKIRK, G. M. YASIKI, O. T. 12-62 32P CY 1,2 U			
THIN-FILMS COMPUTERS			AMP AMP
UNITED STATES ASSOCIATION FOR SCIENTIFIC USE OF COMPUTING FACILITIES			

SELKIRK, G. M.			
YASIKI, O. T.			
BZD 44-246-9A16			
COMPUTERS			AMP
THIN-FILMS			AMP
UNITED STATES ASSOCIATION FOR SCIENTIFIC USE OF COMPUTING FACILITIES 63-97465 TR-7321 MICHIGAN INTENSIVE INSTITUTE FOR RESEARCH IN PHYSICS AND ELECTRONICS BZD 44-246-9A16 COMPUTER MEMORY FOR OPTIMAL PERFORMANCE UNDER HIGH SPEED REQUIREMENTS CONDITIONS SELKIRK, G. M. YASIKI, O. T. 12-62 32P CY 1,2 U THIN-FILMS COMPUTERS			
			AMP AMP

SAMPLE OF SECOND-GENERATION ABC DICTIONARY

• • • AMPLIFIER -- GENERAL • • •	
• • • AMPLIFIER -- GAIN CONTROL • • •	
ANALYSIS OF PHASE DISTORTION DUE TO AGC IN FB TRANSISTOR AMPLIFIER •	AN AERU
MID-FREQUENCY RANGE GAIN-CONTROL FOR TRANSISTOR AMPLIFIER WITHOUT VARYING DC BIAS •	AGOL
• • • AMPLIFIER -- MULTISTAGE • • •	
MONOGRAPH FOR DESIGN OF RC-COUPLED TRANSISTOR AMPLIFIER •	ACOT
FREQUENCY-RESPONSE OF TRANSISTOR TRANSFORMER-COUPLED AF AMPLIFIER •	AFHO
MATRIX OF ONE-ARM OF WIEN-BRIDGE APPLIED AS SELECTIVE RC AMPLIFIER •	ADGC
DERIVATION OF THE	
DESIGN OF RESISTANCE-COUPLED TRANSISTOR AMPLIFIER F4-5, GAIN-P60 •	ACKS
TRANSISTOR RC-COUPLED HIGH-FREQUENCY AMPLIFIER F8, GAIN-P12 •	AEOH
THREE-STAGE CASCADED AMPLIFIER FOX, FBX, 32-BANDWIDTH, GAIN-P34 •	ALOI
MAXIMUM GAIN BANDWIDTH PRODUCT FOR 2-TERMINAL TRANSISTOR AMPLIFIER INTERSTAGE •	IFAH
OF TRANSISTORIZED DISTRIBUTED- AND CASCADED- AMPLIFIER AMPLIFIER •	ACOL
• • • AMPLIFIER -- DISTORTION • • •	
ANALYSIS OF PHASE DISTORTION DUE TO AGC IN FB TRANSISTOR AMPLIFIER •	AN AERU
PREDISTORTION METHOD OF MULTI-TUNNEL-DIODE-AMPLIFIER AMPLIFIER DESIGN •	ADAC
• • • AMPLIFIER -- FEEDBACK IN AMPLIFIERS • • •	
HALL-EFFECT MULTIPLIER USING FEEDBACK AMPLIFIER TO REDUCE PHASE-SHIFT-DISTORTION •	AAVL
TEMPERATURE-STABILIZATION OF TRANSISTOR AMPLIFIER WITH ZENER-DIODE FEEDBACK-NETWORK •	AFDS
• • • AMPLIFIER -- MINIATURIZATION • • •	
R, GAIN, AND STABILITY, IN MICROELECTRONIC SMALL SIGNAL AMPLIFIER •	AFTL
DESIGN AND FABRICATION OF BANDPASS AMPLIFIER USING INTEGRATED-CIRCUITS •	ADCY
RELATIONSHIP OF POWER	
• • • AMPLIFIER -- THEORY AND DESIGN • • •	
• • • AMPLIFIER -- ANALYSIS AND SYNTHESIS • • •	
ANALYSIS AND DESIGN OF P2X.25 COMPENSATED TRANSISTOR AMPLIFIER •	AFCE
COMPARISON, AND DESIGN OF BROAD-BANDED, LOW-PASS TRANSISTOR AMPLIFIER •	AFMF
GENERAL SYNTHESIS OF TUNNEL-DIODE AMPLIFIER AND SENSITIVITY-MINIMIZATION •	AFZW
• • • AMPLIFIER -- DESIGN • • •	
ANALYSIS AND DESIGN OF P2X.25 COMPENSATED TRANSISTOR AMPLIFIER •	AFCE
DESIGN ANALYSIS OF SINGLE-TUNED TRANSISTOR BANDPASS AMPLIFIER •	AFHI
AND GRAPHIC DESIGN FOR SERIES TUNED NEGATIVE-RESISTANCE AMPLIFIER •	AEMH
COMPARISON, AND DESIGN OF BROAD-BANDED, LOW-PASS TRANSISTOR AMPLIFIER •	AFMF
ANALYTIC ANALYSIS, CO	
• • • AMPLIFIER -- APPLICATIONS • • •	
MINIATURIZED ELECTROCARDIOGRAPH CARRIER AMPLIFIER •	AFSI
AN EXPERIMENTAL TUNNEL-DIODE AMPLIFIER FOR F7-8 APPLICATION •	AFQY
TRANSISTOR-RELAY AMPLIFIER FOR ANALOG-COMPUTER •	ACDC
FREQUENCY-CONVERSION MAGNETIC REPEATER AMPLIFIER FOR LOW-LEVEL SUBMARINE	ACDT
TELEGRAPH-CABLES	
CONSTANT TEMPERATURE ONE-TRANSISTOR AMPLIFIER FOR SELENIUM PHOTOVOLTAIC-CELLS •	AEMK
VP2X.6-OUTPUT •	
POWER-SUPPLY, CHOPPING OSCILLATOR AND TUNED AMPLIFIER FOR SENSITIVE PHOTOMULTIPLIER •	ACQY
HYBRID DC AMPLIFIER FOR THERMOCOUPLE AND RESISTANCE	AFFO
THERMOMETER, ALSO FOR OTHER PURPOSES •	
TRANSISTOR FERRITE-CORE AMPLIFIER PROVIDES BASIC LOGIC-CIRCUIT FOR	AFWE
SWITCHING-EQUIPMENT •	
A DETAILED DESCRIPTION OF DESIGN OF A	
MINIATURIZED ELECTROCARDIOGRAPH TRANSISTORIZED CARRIER AMPLIFIER SYSTEM •	AFUM
SIX-CHANNEL RC-COUPLED AMPLIFIER USED AS GALVANOMETER-DRIVER UP TO	ACOX
F4 •	
STABLE TRANSISTOR AMPLITUDE COMPRESSION AMPLIFIER USED AS MULTICHANNEL DISTRIBUTOR •	AFEI
EXPERIMENTAL EVALUATION	
OF THE PHASE-SENSITIVE 3-STAGE TRANSISTOR MONODYNE-TYPE AC AMPLIFIER USED IN THE HOLMES-JOHNSON AND LAROCHE	AFHX
RADIATION DETECTORS •	
• • • AMPLIFIER -- CHARACTERISTICS • • •	
EFFECT OF FET ON LOW NOISE HIGH IMPEDANCE AMPLIFIER •	AGAU
RELATIONSHIP OF POWER,	
GAIN, AND STABILITY, IN MICROELECTRONIC SMALL SIGNAL AMPLIFIER •	AFTL
A BASIS FOR THE ANALYSIS OF HARMONIC	
DISTORTION IN BALANCED AND UNBALANCED CLASS-AB PUSH-PULL AMPLIFIER •	AFIL
ANALYSIS, COMPARISON,	
AND DESIGN OF BROAD-BANDED, LOW-PASS TRANSISTOR AMPLIFIER •	AFPF
SOME COMMENTS ON THE INFLUENCE	
OF STABILITY ON THE FIGURE FOR NEGATIVE-CONDUCTANCE AMPLIFIER •	ARIZ
DESIGN CONSIDERATIONS AND PARAMETERS OF NEGATIVE FEEDBACK AMPLIFIER WITH ADJUSTABLE TO INFINITY INPUT-	AAUZ
IMPEDANCE INDEPENDENT OF OUTPUT LOAD AND	
CERTAIN OTHER PARAMETERS •	
TRANSISTOR AMPLIFIER 2.6-INPUT F-1-5-BANDWIDTH FOR HIGH-	AAPB
IMPEDANCE MODE •	

SAMPLE OF CURRENT AWARENESS LISTING

CATEGORY NO.	PROCESSING NO.	SOURCE	DATE	DESCRIPTORS
0170	051512	JETAS	1261	21617 58360 76083 84017
				REFRIGERATION FOR SPACE-BORNE CRYOGENIC NAVIGATION SYSTEMS. JPL A1
0170	051520	KONASA	0362	17629 31910 32782 52773 54947
				OPTIMAL FILTERING AND LINEAR PREDICTION APPLIED TO A MIDCOURSE NAVIGATION SYSTEM FOR THE CIRCUMLUNAR MISSION. JPL A1
0170	051525	WCCIT	1161	32782 56637 54947 60735 81939
				GITE CARLO SIMULATION OF THE MIDCOURSE GUIDANCE FOR LUNAR FLIGHTS. JPL A1
0170	052321	MIRAND	0262	20105 17086 19155 73141
				COMMUNICATION SATELLITES ESSENTIAL COMMAND AND CONTROL PURPOSES IN THE MID-SIXTIES. AD 328-237
0170	052342	KONASA	1060	20225 24992 24894 27012 41434 75755
				A HOPING MISSILE CONTROL SYSTEM TO REDUCE THE EFFECTS OF RADOME DIFFRACTION. AD 222 495
0170	052605	KIPHILC	0859	06260 11754 58360 72601 81527
				PRESSAR, THE APPLICATION OF SIDE-LOOKING RADAR TO BOMBING-NAVIGATION SYSTEMS IS DISCUSSED. AD 312 017
0170	052609	RIRCA	0859	11754 24870 58360 72601 81527 58327
				ELECTROFAX RECORDING SYSTEM FOR SIDE-LOOKING RADAR. AD 313 710
0170	053637	JEIRE	0661	50503 58549 84069 90518 20105
				LOGARITHMIC NAVIGATION FOR PRECISE GUIDANCE OF SPACE VEHICLES. IAA 9-61
0170	053906	KIAEROS	0661	32790 61969 84099
				ATTITUDE REFERENCE AS ESTABLISHED BY A HORIZON SCANNER. AD 261 140
0170	054096	MIRAND	1061	20105 19155 61969 70143 79141
				AN ORBITAL CONTROL PROCESS FOR A 24-HOUR COMMUNICATION SATELLITE. TECH. PUB. ANN UN. 5-62
0170	054295	KISCA	0661	03168 67431 84099
				PHASE CURVES AND ALBEDOS OF TERRESTRIAL PLANETS. AD 261 165
0170	054297	KISCA	0861	07468 15702 49692 52728 84099
				INVESTIGATION OF PHYSICAL PHENOMENA FOR SPACE NAVIGATION. AD 261 166
0170	054299	KISCA	0761	15702 49692 84099 85466
				INTERPLANETARY NAVIGATION STUDIES. CHAPTERS OF TERRESTRIAL PLANETS - WITH APPENDIX IN THE OUTER PLANETS. AD 261 167

APPENDIX C

DEVELOPMENT OF SECOND - GENERATION ABC SYSTEM

DEVELOPMENT OF SECOND - GENERATION ABC SYSTEM

Problems were encountered in the first-generation model of the ABC System (see Figure C-1). It was recognized that certain disruptions introduced by automatic alphabetization had to be eliminated, and concepts that rapidly accumulated in the ABC Dictionary under broad and significant content words -- amplifiers, antennae, diodes, lasers, oscillators, plasma, transistors, etc. -- should be organized for rapid and easy location.

Therefore, as a part of the performance test requested by DoD, work was undertaken to prepare a practical, flexible scheme for grouping in subdivisions the information under the different important keywords, to prepare a program capable of listing the same concept under at least three of the logical subdivisions of such a special superposed scheme whenever desirable, and to automate all clerical functions, such as the reproduction of the required numbers of concepts, the filing of the concepts into the various subdivisions, and the printing of the organized sections and subsections of the ABC Dictionary.

Subgroups of subject schemes (miscroschedules) for 30 different keywords have been introduced. The number of subdivisions in one given scheme is limited to 676 because of the two-letter code used for identifying them in the machine program. These codes

FIGURE C-1

FIRST GENERATION ABC DICTIONARY (SAMPLE)

DERIVATION OF POWER-GAIN IN TUNNEL-DIODE*	RUBY LASER* AMPLIFIER	GAIN-14,	F7-BANDWIDTH =	AEAT
MINIATURIZED ELECTROCARDIOGRAM* CARRIER	AMPLIFIER			AFGY
EFFECT OF FET* IN LOW NOISE HIGH IMPEDANCE	AMPLIFIER			A ^{CSI}
ALYSIS OF PHASE DISTORTION* DUE TO AGC IN F8 TRANSISTOR	AMPLIFIER			AGAU
-FREQUENCY COMPENSATION* OF DRIFT-TRANSISTOR AND OF TUBE	AMPLIFIER			AERU
TORTION* IN MICROELECTRONIC* SMALL SIGNAL	AMPLIFIER			AX
LITY* EQUATION FOR DIFFERENT TYPES OF TRANSISTOR VOLTAGE	AMPLIFIER			HIGH AOKX
EL-DIODES* =	AMPLIFIER			AFIL
	AMPLIFIER			AFHS
	AMPLIFIER			AEUG
	AMPLIFIER			AFCH
	AMPLIFIER			AFQJ
	AMPLIFIER			AFOT
	AMPLIFIER			ADZW
	AMPLIFIER			ADHE
	AMPLIFIER			AHXS
	AMPLIFIER			AFHX
	AMPLIFIER			ADLV
	AMPLIFIER			AERK
	AMPLIFIER			AEQY
	AMPLIFIER			AFFB
	AMPLIFIER			ACFW
	AMPLIFIER			AAXS
	AMPLIFIER			AFWE
	AMPLIFIER			AFVM
	AMPLIFIER			AAVL
	AMPLIFIER			AFYF
	AMPLIFIER			AFHX
	AMPLIFIER			ADHX
	AMPLIFIER			AGOH
	AMPLIFIER			AFAY
	AMPLIFIER			AAUQ
	AMPLIFIER			AFBS
	AMPLIFIER			AGDL
	AMPLIFIER			ADFI
	AMPLIFIER			ADKS
	AMPLIFIER			AEDH
	AMPLIFIER			AEDG
	AMPLIFIER			AED1

APPENDIX C(3)

(alphabetically arranged) for each subsection into which they are to be inserted are added to the respective keywords of a concept.

The second-generation system will insure the following computer operations: 1) alphabetization by keywords; 2) recognition of the different codes attached to them; 3) reproduction of the required number of concepts; 4) arrangement of the concepts by the code symbols; 5) insertion of the headings ahead of the subdivisions (corresponding to the code) from a second tape; and 6) printout of the subheadings and concepts in order and eliminating the codes from the printout.

Two additional format changes were designed to improve the appearance and usefulness of the Dictionary. First of all, the length restriction of the individual concept to one line was eliminated. A new program will accommodate concepts of any length. Second, the concepts are printed in a different arrangement, with double printing to produce a bolder typeface for the headings.

Although the secondary organization of the concepts around the key term are mainly accomplished by superposed subject schemes, refinement of rules for concepting will continue. Something other than the rule that an overall concept must be prepared to tie

APPENDIX C(4)

together the various different concepts assigned to one paper is needed. In addition, considerable attention will be given to the standardization not only of the terminology but also of the syntax as soon as practical results are available through research on generative grammar and automatic translation methods.

Another major objective of the second-generation ABC method is the reduction of the Dictionary to the smallest possible size by moving some information to the card catalog. The major items in this operation are parameters and descriptive information.

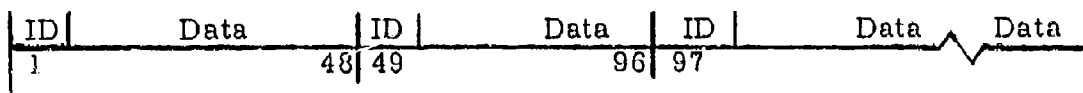
APPENDIX D

FILE FORMATS

FILE FORMATS

FIGURE D-1

Storage File 2	Cumulative Catalog File
Storage File 3	Partial Subject File
Storage File 7	Reports Subject File
Intermediate File 1	Drive 1 from BULLETIN PRINT Program
Intermediate File 3	Drive 5 from BULLETIN PRINT Program



These records are of variable lengths. Each subunit is 48 characters long. ID is two characters; the first is the card type code indicating the type information in the data field (see page 17 in Program Systems Data) and the second digit is for sequencing continuation cards of a given type. Data are 45 characters followed by one blank.

FIGURE D-2

Storage File 4	Cumulative Rotated Title File
Intermediate File 5	Drive 2 from PRINT BE-PIP Program

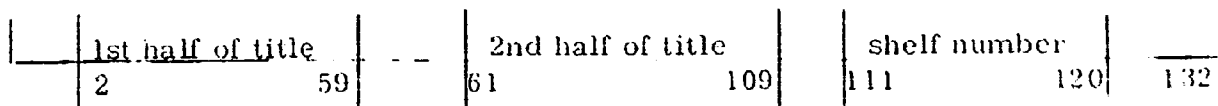


FIGURE D-3

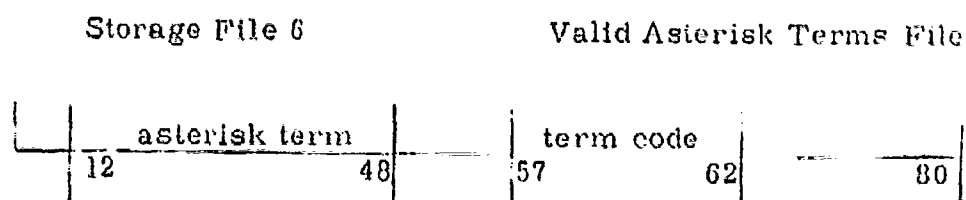


FIGURE D-4

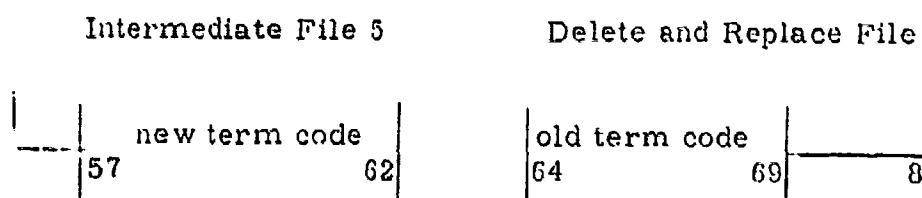


FIGURE D-5

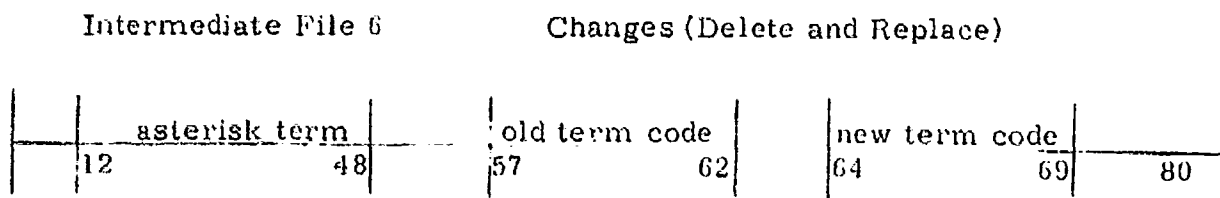


FIGURE D-6

Storage File 5

ABC Dictionary File

Intermediate File 2

Drive 4 from BULLETIN PRINT Program

ID		code		data	
1	2	3	7	19	65
					84

The above format pertains specifically to storage file 5.

However, the format for intermediate file 2 is the same except that

"shelf number" replaces "code".

The first character of ID is either T for title or A for author.

The second character is a sequence number. Column three contains a period to indicate the last record of a set.

FIGURE D-7

Intermediate File 7

Compare and Change Asterisk Term

asterisk term		old code		new code	
12	48	57	62	64	69
					80

FIGURE D-8
Dictionary Update Cards

Card 1

change or
add card

T or A	Sequence No.		Code	Data
1	2	3	7 17	19 65 80

Card 2

Delete
and Replace
Card

D	old code	new code	
1	7 17	19 29	80

Unclassified
Security Classification

DOCUMENT CONTROL DATA - R&D		
<small>(Security classification of title, body of abstract and indexing annotation must be changed when the report is changed.)</small>		
1. ORIGINATING ACTIVITY (include name and address) BOOZ ALLEN APPLIED RESEARCH, INC. 4733 Bethesda Avenue Bethesda, Maryland 20014		2. SECURITY CLASSIFICATION Unclassified
3. REPORT TITLE Mechanization Study of the U.S. Army Harry Diamond Laboratories Technical Information Office, Washington, D.C.		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Final Report of on-site survey		
5. AUTHOR(S) (Last name, first name, initial) G. A. Kershaw, D. Crowder, J. E. Davis, E. G. Loges, E. Merendini, S. M. Thomas		
6. REPORT DATE September, 1966	7A. TOTAL NO. OF PAGES 61	7B. NO. OF REFS. 2
8A. CONTRACT OR GRANT NO. DSA-7-15489	9A. ORIGINATOR'S REPORT NUMBER(S) 914-1-2	
9. PROJECT NO.	9B. OTHER REPORT NUMBER(S) (Any other numbers that may be assigned this report) AD 640 101	
10. AVAILABILITY LIMITATION NOTICES Distribution of this Document is unlimited		
11. SUPPLEMENTARY NOTES None	12. SPONSORING MILITARY ACTIVITY Defense Supply Agency Defense Documentation Center Cameron Station, Virginia	
13. ABSTRACT Mechanized library functions are performed on the IBM 7094 and 1410 computers using the Approach-By-Concept (ABC) storage and retrieval system. At present, mechanization is applied only to technical reports. The four outputs are accessions lists with supplementary KWIC Index, catalog cards, the ABC Dictionary, and current-awareness notifications. These notifications are provided as a result of the Martin Company contract for analyses of current open-source publications in selected subject areas. Because of file organization problems encountered in the first-generation model of the ABC system, a second-generation model was developed which will become operational in the near future. Periodicals are presently controlled with the aid of EAM techniques with a view to computerization in the near future. The Library staff states that the program has developed smoothly, with problem areas being worked out before they became serious.		

Security Classification

14	KEY WORDS	LINK A		LINK B		LINK C	
		ROLE	WT	ROLE	WT	ROLE	WT
	Digital Computers						
	Information Retrieval						
	Electronic Accounting Machines						
	Libraries						

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4. **REPORT TITLE:** Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parentheses immediately following the title.

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7. **REPORT DATE:** Enter the date of the report as day, month, year, or month, year. If more than one date appears on the report, use date of publication.

8. **TOTAL NUMBER OF PAGES:** The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

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16. **SPONSORING MILITARY ACTIVITY:** Enter the name of the departmental project office or laboratory sponsoring (paying for) the research and development. Include address.

17. **ABSTRACT:** Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as (TS), (S), (C), or (R).

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

18. **KEY WORDS:** Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.